

Pump System Maintenance for Reliability Course Objectives

Pump Fundamentals and Basic Hydraulics Review

Upon completion of this module, you will be able to:

- Describe components and functions of the pump
- Describe the types of pumps available
- Describe performance of the centrifugal pump
- Define terms “Best Efficiency”, “NPSH”, etc.
- Identify information shown on Pump Performance Curves
- Interpret and apply Pump Performance Curves
- Interpret and apply System Performance Curves

Life Cycle Costs (LCC)

Upon completion of this module, you will be able to:

- Discuss key factors that impact Life cycle Costs
- Identify the importance of the entire system approach
- List the elements of LCC
- Discuss the impact of tradeoffs for the elements of LCC

System Approach

Upon completion of this module, you will be able to:

- Discuss the system components and identify how each component affects the system as a whole
- Identify critical system objectives
- Discuss how to preserve the critical system objective within the system approach

Factors of Pump reliability

Upon completion of this module, you will be able to identify the factors that impact reliability, including:

- System design
- Pump selection
- Installation
- Operation
- Maintenance practices

Pump Operation Safety

Upon completion of this module, you will be able to identify safe and unsafe operational practices for:

- Components upstream of the immediate locale of the system
- Individual pumps and components in the immediate locale
- Components downstream of the immediate locale of the system

Procedures for Pump Operation

Upon completion of this module, you will be able to describe procedures for proper centrifugal pump operation, including:

- Start up procedures
- Shut down procedures
- Pre-heat considerations
- Thermal expansion considerations

Normal Operation

Upon conclusion of this module, you will be able to describe, compare and contrast common / typical methods of centrifugal pump operation, including:

- Continuous Operation
- Intermittent Operation
- Constant Speed Operation
- Variable Speed Operation
- Throttled Operation
- By-pass Operation
- Maximum/Minimum Speed
- Maximum/Minimum Flow

Other Modes of Operation

Upon completion of this module, you will be able to describe, compare and contrast less common methods of centrifugal pump operation, including:

- Parallel Operation
- Series Operation
- Dissimilar Pump Operation
- Multiple Suction Configurations
- Multiple Discharge Configurations
- Sump Operation
- Self Priming Operation

Coupling Considerations

Upon completion of this module, you will be able to:

- Describe, compare, and contrast the features of the following types of couplings:
 - Rigid
 - Flexible
 - Gear Type
 - Universal Joint Type
 - Elastomeric
 - Spring Type
 - Metal Disc Pack
 - Magnetic
 - Clutches
- Describe the factors involved in coupling selection and identify improperly selected couplings

Caring for Pump Shaft Seals

Upon completion of this module, you will be able to:

- Describe the purpose of shaft seals
- Identify the different seal types and describe the application and benefits of each type
- Identify the different seal arrangements and their application
- Identify the causes of seal failures
- Describe how to extend seal life

Bearing Design and Application

Upon completion of this module, you will be able to:

- Identify different bearings and classifications
- Describe the application of each bearing type
- Identify lubrication methods and benefits of each method
- Identify bearing installation process and configurations
- Identify the different types of available bearing closures and the advantages and disadvantages of each type

Pump Selection Considerations

Upon completion of this module, you will be able to:

- Describe the effects of the following considerations on proper pump selection:
 - Hydraulic
 - Mechanical
 - Installation
 - Operational
 - Reliability
 - Life Expectancy
 - Environmental
 - Specifications
 - Spare Parts

Troubleshooting

Upon completion of this module, you will be able to describe the contributing factors and characteristics of:

- Pump System Problems
- Mechanical Pump Problems
- Temperature/Vibration Problems
- Troubled Operations/Performance Issues

Driver Selection Considerations

Upon completion of this module, you will be able to:

- Define common terminology used for drivers
- Describe, compare, and contrast the features of various:
 - Motor types
 - Variable speed drives
 - Other drives
- Describe the factors involved in driver selection and identify improper driver selection

Condition Monitoring and Root Cause Failure Analysis

Upon the conclusion of this module, you will be able to:

- State the benefits of implementing a comprehensive condition monitoring program
- Describe the tools used in condition monitoring
- Describe the basic concepts used in root cause analysis and identify the benefits
- Identify the process steps in the root cause analysis process and describe how they are used

Pump Construction Materials

Upon completion of this module, you will be able to:

- Discuss the factors associated with selecting an appropriate pump material
- Identify the factors that indicate when certain pump materials are required
- Discuss the liquid characteristics that impact material selection
- Identify common pump construction materials, including:
 - Coatings
 - Linings
 - Platings

Baseplate Installation Considerations

Upon completion of this module, you will be able to:

- Describe, compare, and contrast the features for the following mounting systems:
 - Standard bases
 - Spring bases
 - Pedestal mount
 - No bases
 - Ceiling/wall mount
- Recognize installation procedure best practices

Pump Mounting Considerations

Upon completion of this module, you will be able to:

- Describe correct installation procedures for the pump and driver
- Describe correct pump to driver alignment procedures
- Identify critical factors of piping support and connection to pump
- Recognize installation procedure best practices

Pump Repair and Overhaul

Upon completion of this module, you will be able to:

- Disassemble a centrifugal pump in accordance with manufacturer instructions
- Perform a critical inspection of the pump and its components to identify damage
- Describe the course of action based on tell tale signs discovered during disassembly
- Correctly reassemble and adjust the pump